

SYSTEMATICS OF THE ERICAMERIA CUNEATA COMPLEX (COMPOSITAE, ASTEREAE)

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Ericameria cuneata (Gray) McClatchie is a highly variable, wide ranging taxon occurring from the northern Sierra Nevada and Coast Ranges south of Monterey, California, to central Baja California and southeastern Arizona. Populations of *E. cuneata* are usually restricted to rocky outcrops at elevations from 750 to 2750 m and occupy diverse vegetation zones ranging from creosote bush scrub in the Mojave Desert to yellow pine forests in the northern Sierra.

Ericameria cuneata was described by Gray (1873) as *Haplopappus cuneatus* and based on radiate specimens collected in the Sierra. In 1876 Gray described *Bigelowia spathulata* and noted its resemblance to *H. cuneatus* but distinguished it from the latter on the basis of eradiate heads, nonglutinous and obscurely punctate foliage, noncarinate phyllaries, shorter more silky achenes, and clavate pappus bristles. In 1886, admitting some eradiate taxa to *Haplopappus*, Gray placed *B. spathulata* and *B. rupestris* Greene (1881; Arizona) in synonymy with *H. cuneatus*. Greene (1895) treated *Ericameria* as congeneric with *Chrysoma*. Eastwood (1905), accepting Greene's treatment, described *C. merriamii* from material collected in Kern County, California. Hall (1928), the last monographer of the group, having only limited material available, viewed *B. spathulata*, *B. rupestris*, and *C. merriamii* as taxonomically insignificant variants of *H. cuneatus*.

MATERIALS AND METHODS

Field observations and collections were made during the early fall months of 1972 and 1973. Usually, five to ten plants were collected from each population. Morphological analyses also utilized specimens borrowed from the following herbaria: ARIZ, ASU, CAS, COLO, DAV, DS, F, GH, JEPS, LL, MICH, MO, NY, OSC, PH, POM, RSA, SD, SMU, TEX, UC, UCSB, US, UTC, WS, WTU. Leaf measurements and shapes were based on the largest leaf per specimen; length measurements included the petiole, and width was measured at its widest point. Number of disk florets per head represents an average based on counts from three heads for each plant. Means, ranges, and standard deviations for each population are based on measurements from 10 to 20 individuals.

Chromosome number determinations (all $n = 9$) were made for the collections cited below using aceto-carmine squashes of pollen mother cells from bud material that was collected in the field and preserved in modified Carnoy's solution (chloroform:ethanol:acetic acid, 4:3:1 v/v). Voucher specimens are in LL; collection numbers are mine. *Ericameria cuneata* var. *cuneata*: CA, Kern Co., 11 mi. NW of Tehachapi, 1533; Tuolumne Co., along the road to Hetch-Hetchy Reservoir, 9.7 mi. from

Jct. of 120 X Rd. to Hetch-Hetchy, 1521; *E. c.* var. *macrocephala*: CA, San Diego Co., Desert View, Mt. Laguna, 1538; *E. c.* var. *spathulata*: AR, Santa Cruz Co., Sycamore Canyon, 1541.

RESULTS AND DISCUSSION

Ericameria cuneata in the northern Sierra Nevada occurs at ca 2150 m in association with *Pinus ponderosa*, *P. jeffreyi*, *Libocedrus decurrans*, *Quercus kelloggii*, and *Arctostaphylos* spp., grows as a rounded shrub less than 4 dm tall, and has small, sessile, cuneate leaves (fig. 1, A). Populations in the central and southern Sierra and the San Bernardino and San Gabriel Mountains range down to 1050 m, usually occur with foothill woodland taxa, and have somewhat larger, cuneate leaves. The

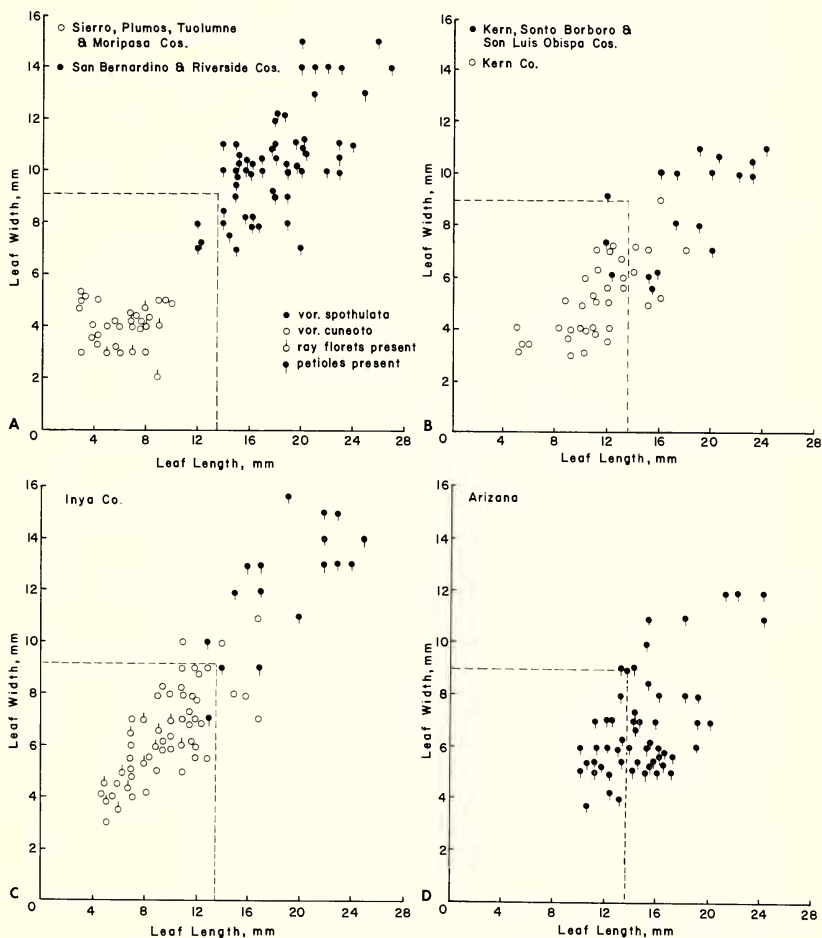


FIG. 1. Scatter diagrams showing variation in leaf size, presence of petioles, and presence of ray florets in populations of *Ericameria cuneata*. The dash lines are included as reference points.

cuneatas on the eastern face of the Sierra and in the White and Inyo Mountains, where the habitat is more xeric and supports *Pinus monophylla*, *Juniperus* sp., *Chrysothamnus teretifolia*, and *Artemisia* sp., often form semiprostrate, mat-like shrubs to 1 m in diameter and have sessile, cuneate but broader leaves than those in the central Sierra (fig. 1, C).

In southeastern California *Ericameria cuneata* is associated with Joshua tree woodland and creosote bush scrub, grows upright to 1 m tall, and has large, petiolate, spatulate leaves (12–30 mm long; fig. 1, A). Similarly, the Arizona populations occupy xeric sites but have somewhat smaller, more slender petiolate, spatulate leaves (fig. 1, D). The cuneatas in Baja California are primarily associated with pinyon-juniper woodland and have spatulate leaves that exhibit the same size range as the Arizona populations but have shorter, stouter petioles. The Arizona and Baja California cuneatas are smaller in habit than those in the Mohave desert.

On the basis of habitat, leaf shape, and to some extent leaf size, two taxa can be delimited among the aforementioned populations. One occurs at higher elevations, is adapted to cooler, more mesic habitats, and has smaller, cuneate, sessile leaves; the other has larger, spatulate, petiolate leaves and is adapted to xeric areas.

These taxa are fairly distinct throughout most of their ranges, but they intergrade in areas of sympatry, notably in the Tehachapi and Greenhorn Mountains in Kern County, California (fig. 1, B); this corresponds to a region where their usually distinct habitats gradually intergrade (Stebbins and Major, 1965). Populations that occur in the Coast Ranges are morphologically similar to those in the transition zone (fig. 1, B).

On the basis of their morphological variation pattern, these entities are treated as varieties. The correct name for the cuneate-leaved, more mesic taxon is *E. cuneata* var. *cuneata*; that for the more xeric element is *E. cuneata* var. *spathulata*. These taxa are treated formally in the systematic section of this paper. A summary of variation in leaf size and shape for the two varieties is given in Figure 2.

Ray florets are lacking in var. *spathulata*, while they are sporadically present in many populations of var. *cuneata* and regularly occur in the northernmost populations of this variety. Although this character is of little taxonomic value, it may be of considerable adaptive value in reproductive biology, especially in the northern populations. Both varieties have similar numbers of disk florets per head except for the northern populations of var. *cuneata* and the Arizona populations of var. *spathulata* that have fewer (fig. 3).

Populations of *E. cuneata* in the Laguna Mountains differ drastically from the aforementioned varieties in having fewer but much larger heads with considerably more florets (fig. 3) and more numerous phyllaries. Since these populations are well isolated geographically and are distinct morphologically, I propose that they be recognized as a third variety of

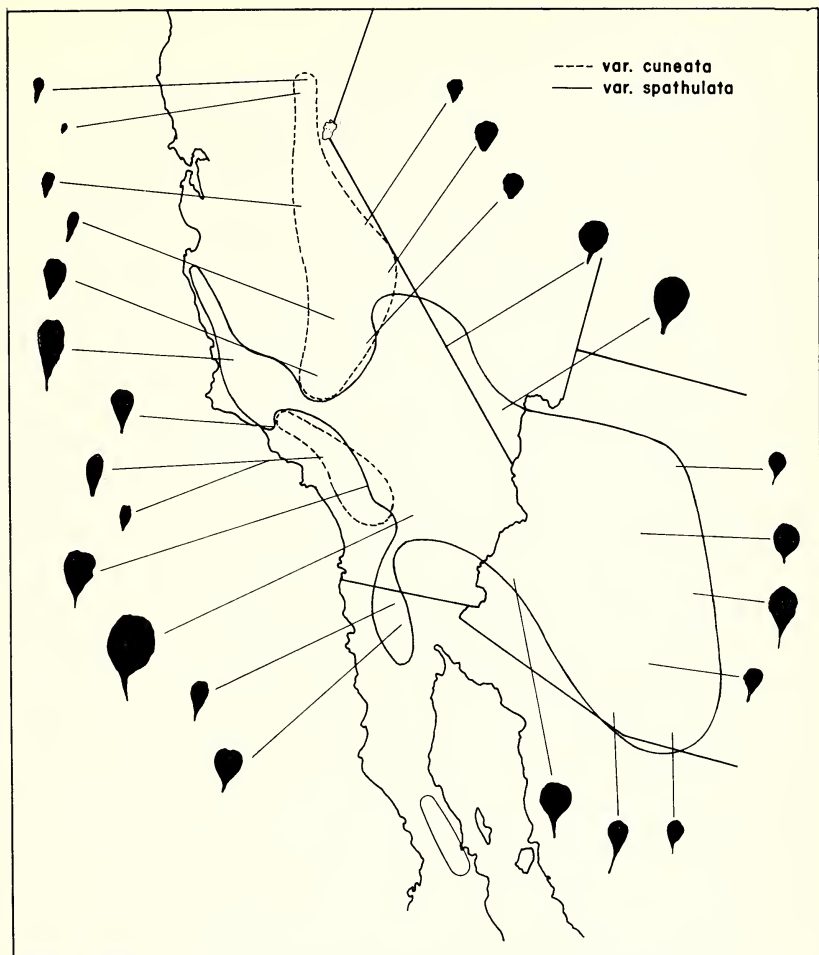


FIG. 2. Leaf silhouettes depicting variation in leaf size and shape throughout the ranges of *Ericameria cuneata* var. *cuneata* and var. *spatulata*.

E. cuneata, namely var. *macrocephala*. Occurrence of occasional teratological heads in *macrocephala* that have the appearance of being aggregations of "partly-fused" smaller heads suggests that this variety evolved from an ancestral form having many, small, cymosely arranged heads much like present day var. *cuneata*.

Karyological studies show that the chromosome number for all varieties is uniformly $n = 9$, which agrees with an earlier report (Solbrig et al., 1964).

TAXONOMIC TREATMENT

ERICAMERIA CUNEATA (Gray) McClatchie, *Erythea* 2:124. 1894.

Evergreen shrubs 1–10 dm tall, intricately branched, usually rounded;

stems to 3 cm thick at base, weakly ascending to erect, young stems green or tan becoming gray on older branches; leaves cuneate to spatulate, 2–25 mm long, 2–16 mm wide, petiolate or sessile, apices mucronate or retuse, resinous dots and usually a heavy resinous coat on both leaf surfaces; capitulescence of rounded, compact, cymose clusters, up to 8 cm broad and 5 cm high; involucre turbinate to subcampanulate, 4–14 mm broad, 6–12 mm high, phyllaries imbricate, in 3–6 graduated series, lanceolate to obovate, chartaceous, glabrous, the apices acute to obtuse or sometimes acuminate, the margins membranous, outer phyllaries 1–2 mm long, 0.5–1.5 mm wide, often resinous, inner phyllaries 2.5–6.0 mm long, 1.7–2.0 mm wide; capitula usually eradiate, but radiate in some populations, ray florets 0–7; ray corollas ca 7 mm long, glabrous, occasionally with sparse resinous dots, ligules ovate, ca 4 mm long, 1.5 mm wide; disk florets 7–70, disk corollas ca 5.5 mm long, glabrous, the tube gradually ampliate into a cylindrical limb, lobes triangular acute, ascending or somewhat spreading, ca 0.7 mm long; pappus identical on disk and ray florets, composed of ca 30 subequal, setose, capillary bristles per floret, brownish-white, nearly as long as the disk corollas; achenes prismatic, 2.5–3.0 mm long, usually 5-ribbed, pubescent, often densely so with silky ascending twin hairs to 0.8 mm long; $n = 9$.

Key to varieties of *Ericameria cuneata*

- a. Disk florets 33 or fewer per head; widely distributed in California, Arizona, Baja California. b.

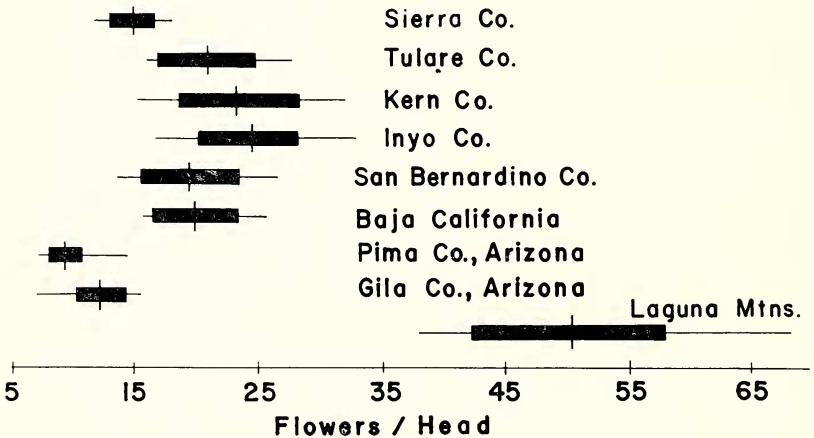


FIG. 3. Variation in disk floret number of representative populations of *Ericameria cuneata*. The top four populations represent var. *cuneata*, the next four represent var. *spathulata*, while the lowermost represents individuals from the Laguna Mtns. The mean number of florets per head for a sample is given by the vertical line, the range by the horizontal line, and two standard deviations by the bar. The standard errors of the means from top to bottom, respectively, are: 0.36, 0.43, 0.36, 0.30, 0.42, 0.25, 0.11, 0.58, 0.83.

- b. Leaves cuneate, sessile, largest ones 3–14(18) mm long, 2–9(12) mm wide. 1. var. *cuneata*
 bb. Leaves spatulate, usually with a distinct petiole, the largest ones (9) 12–25 mm long, 4–16 mm wide. 2. var. *spathulata*
 aa. Disk florets 36 or more per head; restricted to the Laguna Mountains, San Diego County, California. 3. var. *macrocephala*

1. ERICAMERIA CUNEATA (Gray) McClatchie var. CUNEATA.—*Happappus cuneatus* Gray, Proc. Amer. Acad. Arts 8:635. 1873.—*Aster cuneatus* (Gray) Kuntze, Rev. Gen. Pl. 1:317. 1891.—*Chrysoma cuneata* (Gray) Greene, Erythea 3:11. 1895. TYPE: In his protologue, Gray cited, "California, in 'Bear Valley, alt. 4,500 feet, Sept.,' Kellogg, Bolander, etc.; no. 402 of Kellogg and Harford's distribution." Two of the collections cited by Gray are in GH: *Bolander* with locality as cited in protologue and *Kellogg and Harford 402* without locality data. The latter is annotated "n. sp." in Gray's hand (fide Rollins, pers. comm.). I here designate *Kellogg and Harford 402* (GH!) as lectotype because Gray obviously saw this specimen and several herbaria have duplicates of it (CAS!, PH!, NY!, US!).

Chrysoma merriamii Eastw., Bull. Torrey Bot. Club 32:215. 1905. TYPE: California, Kern Co., Caliente Creek, 12 Oct 1902, *Merriam s.n.*, Holotype: CAS!

DISTRIBUTION (fig. 4): Plumas Co. south through Sierra Nevada and into the Topatopa Mts., Ventura Co., San Gabriel Mts., Los Angeles Co., White and Inyo Mts., Inyo County. Locally common, usually restricted to granitic outcrops at 1050–2725 m. Mid-August to December.

This taxon is quite variable in habit, leaf size, and occurrence of rays. Generally, plants in more xeric areas have larger leaves. Ray florets are usually present in the northernmost populations and sporadically occur elsewhere. This variety intergrades with *E. c.* var. *spathulata* where their ranges overlap.

2. ERICAMERIA CUNEATA (Gray) McClatchie var. SPATHULATA (Gray) Hall, Univ. Calif. Publ. Bot. 3:52. 1907.—*Bigelowia spathulata* Gray, Greene var. *spathulata* (Gray) Greene, Erythea 3:11. 1895.—*Happappus cuneatus* (Gray) McClatchie var. *spathulatus* (Gray) Blake, Contr. U. S. Natl. Herb. 23:1849. 1926. TYPE: Baja California, Tantillas Canyon (also spelled Cantillas and located in Sierra Juarez Mts., ca 128 km SE of San Diego, near 32°15'N, 116°W fide Ewan, 1937), Sep 1875, *Palmer 133*. Holotype: GH!; isotypes: MO! NY!

Bigelowia rupestris Greene, Bot. Gaz. (Crawfordsville) 6:183. 1881. TYPE: Arizona, Coconino Co., rocky summits of San Francisco Mts., 1 Nov 1880, *Greene s. n.* Lectotype (here designated): GH! isotypes: F! K, POM! [A search at NDG yielded no type material (Crovello, pers. comm.).]

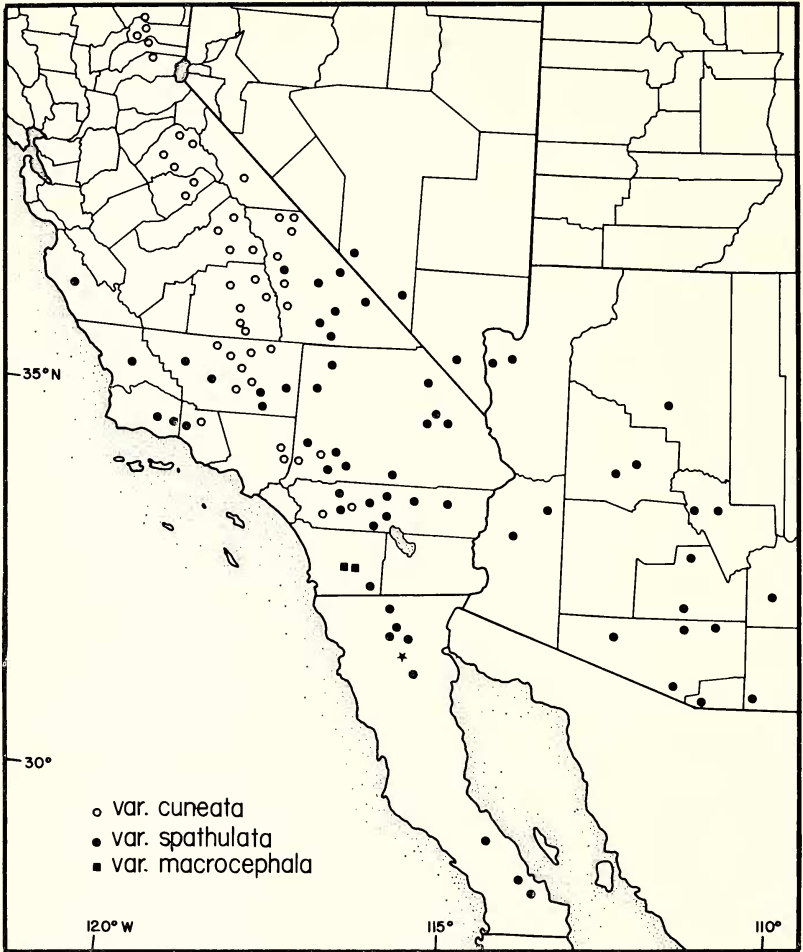


FIG. 4. Distribution of the three varieties of *Ericameria cuneata*. The star indicates the type locality of var. *spathulata*.

DISTRIBUTION (fig. 4): Coast Ranges, Monterey Co., California, south to Sierra San Borja in Baja California and east to Nye Co., Nevada, and Graham Co., Arizona. Locally common, usually on rock outcrops, 750–1850 m. August to December.

This variety is eradiate and variable in leaf size and habit. It occurs predominantly in xeric habitats.

3. *Ericameria cuneata* (Gray) McClatchie var. **macrocephala** Urbatsch, var. nov. Capitula 6–10 mm lata 9–12 mm alta 36–70 flora; flores radiati nulli; involucrem 4–6-seriatum; phyllaria inaequalia.

TYPE: California, San Diego Co., Desert View, Mt. Laguna, ca 1.2 mi N of the town of Mt. Laguna, crevices of steep east-facing outcrop, shrubs to 4 dm tall, eradiate, ca 1850 m, 2 Oct 1974, *Urbatsch and Clark 1538A*. Holotype: LL!; isotypes: LSU!, UC!

DISTRIBUTION (fig. 4): endemic to the Laguna Mountains in San Diego Co. This variety grows among boulders, from crevices in granitic outcrops, or, occasionally, rooted in rocky soil in chaparral near the yellow pine vegetational zone. Mid-September to December.

LIST OF EXSICCATA

Lists of nearly 500 herbarium specimens that formed the basis for much of this study are available from the author.

ACKNOWLEDGMENTS

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